



BOTTOM PLATE ANCHORS

Calls to the BRANZ Helpline indicate that there is still confusion about the correct use of bottom plate anchors with concrete floor slabs.

By Roger Shelton, BRANZ Structural Engineer

Bottom plate anchors are vital components of a building. Their role is to locate and fix the bottom plate against three forces; those of tension (uplift), in-plane and out-of-plane shear.

Tension is required to hold down the roof under wind loading (in bracing and non-bracing applications), and to prevent racking wall overturning (in bracing applications). In-plane shear (along the wall) is a minimal requirement for general robustness and bracing. Out-of-plane shear (across the wall) is required for resistance to face loading from wind and earthquake. It also helps with stability against user type loads such as fixture loads, door slamming etc.

Cast-in anchors not widely used

There are a variety of options for bottom plate anchors which can be grouped as either cast-in or post-fixed.

Cast-in anchors are generic solutions covered in NZS 3604: 1999 *Timber framed buildings*. They are *not* commonly used because of installation difficulties. These anchors are a:

- bent M12 bolt with a 50 x 50 x 3 mm square washer or 55 x 3 round washer
- bent 10 mm dowel clinched and stapled over the plate.

There are also proprietary nail-plate type bottom plate brackets for casting into wet concrete and fixing to the plate.

Cast-in bolts and dowels at the spacing of 1.4 m for bolts and 900 mm for dowels, as prescribed by NZS 3604 Clause 6.11.9.1, meet performance requirements.

Post-fixed anchors more common

Post-fixed anchors are the far more common option. They are proprietary fasteners developed to overcome the practical installation

problems mentioned above. They include:

- expanding or wedge anchors
- anchors chemically grouted into pre-drilled holes
- anchors screwed into pre-drilled holes
- shot fired fasteners.

The performance criteria for post-fixed anchors (for non-bracing walls) is set out in Clause 7.5.12 of NZS 3604.

Performance of anchors in bracing walls is deemed to be covered by the BRANZ P21 bracing test, usually carried out by the proprietor of the bracing wall. *But it is important to remember that these anchors are also required to comply with the criteria of Clause 7.5.12.*

Anchors for mid-slab applications

For internal walls, post-fixed anchors can be shown by test to comply with the NZS 3604 criteria. The depth of penetration into thin slabs could be an issue, however, as there is a risk of damaging the DPM beneath. A tested anchor that does not meet the required values can have its spacing reduced to maintain equivalence. This will be an Alternative Solution outside the scope of NZS 3604, and needs to be supported by well documented test evidence. An example is a proprietary bracing wall with closely spaced shot fired anchors.

Anchors other than generic bolts, dowels, and products covered by test in accordance with Clause 2.4.7 of NZS 3604 *do not comply* with the standard. Builders installing them and BCAs accepting them are therefore acting as designers, with all the responsibility that implies.

Slab-edge installation is tricky

Anchors installed at slab edges can cause problems. Bottom plate widths of 90 mm,



The importance of bottom plate anchors is clearly not understood on this job with one bolt missing.

combined with the 6 mm (minimum) capillary overhang of Figure 7.10 of NZS 3604 (or Figure 132 of E2/AS1), mean that concrete edge distances for anchors in external walls are minimal. Tests have shown that cast-in anchors are satisfactory where in-situ concrete slab edging is used. But they do not meet the NZS 3604 criteria where masonry header blocks are used to form the slab edging (see BRANZ Study Report SR125).

Drilled, proprietary anchors are more difficult. Non-expanding types (chemical or screw) are *generally ok* with in-situ concrete slab edging but in header block applications they will usually fail the out-of-plane criterion. Expanding types (eg, wedge or sleeve anchors) will almost always fail the out-of-plane criterion.

Drilling for post-installation in masonry units requires very careful technique so the drill bit does not break out the masonry face shell. Out-of-tolerance construction often results in drilling right down the interface between concrete and block. Remedial measures will always be a compromise, and may often be hidden from inspection. ❖



Providing an adequate fixing for external bottom plates will not be easy for this slab.



Remedial work can not satisfactorily fix this problem.