



BY ROGER SHELTON,  
SENIOR STRUCTURAL  
ENGINEER

# Bracing for suspended floors

BRANZ HAS BEEN ASKED RECENTLY FOR HELP INTERPRETING NZS 3604:2011 BRACING PROVISIONS FOR BUILDINGS WITH SUSPENDED SUBFLOOR STRUCTURES. HERE ARE A FEW POINTERS.

**Designers will have noticed** that there is a substantial increase in bracing demand from buildings on slabs to those on suspended floors. This ranges from about double the demand for walls of single-storey buildings to about a 30% increase in demand for walls of 2-storey buildings.

This increase is due to the additional seismic weight of the suspended floor and its contents (people, furniture and so on), and the greater effect of earthquake ground movements on suspended floors.

## Experience from Christchurch

Observations in Christchurch after the earthquakes clearly showed that piled buildings with a perimeter foundation wall of concrete or concrete masonry performed very well, even when there was ground disturbance due to liquefaction and lateral spreading.

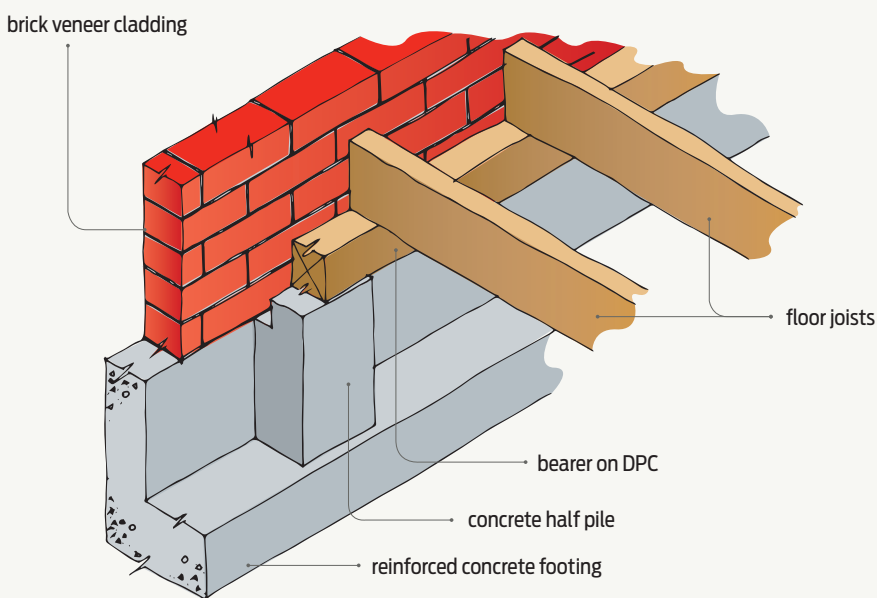
This is because of the bracing effect of the perimeter foundation wall, together with the floor acting as a diaphragm.

## Gap in NZS 3604

NZS 3604:2011 provides two sets of tables for earthquake bracing demand:

- Table 5.10 for buildings built on a concrete slab.
- Tables 5.8 and 5.9 for buildings on a suspended floor structure.

However, NZS 3604 makes no distinction between fully piled suspended substructures and those with a concrete or masonry perimeter foundation.



**Figure 1** Suspended floor structure with semi-detached or half pile.

## Bracing design advice

After discussions with practitioners, BRANZ advises:

- if the building is on a slab, use NZS 3604 Table 5.10
- if the building is all piled, use NZS 3604 Table 5.8 (single-storey) or 5.9 (two-storey)
- if the suspended floor structure is well connected to the perimeter foundation (as required by NZS 3604 Figure 6.17 for bearers and Figure 6.16 for wall plates), treat it as a slab and use Table 5.10
- if the suspended floor structure is not connected to the perimeter foundation (for example, the semi-detached pile in Figure 1 – a common construction detail for older timber-framed buildings), then conservatively Table 5.8 or 5.9 should be used. Structural engineers experienced in timber-framed construction could perhaps justify a demand value between those from Tables 5.8/5.9 and Table 5.10. ◀