



# Guidance on using NZS3604 construction on ground with potential for liquefaction

## BACKGROUND

The latest version, NZS 3604:2011, was published by Standards New Zealand in February 2011, and is now referenced, with some modifications about reinforcing concrete slabs on ground and foundations, as an Acceptable Solution (B1/AS1) in the B1 Structure Compliance Document. With the modifications, the construction details in NZS 3604:2011, are suitable where there is “good ground” as defined in that Standard.

The referencing of NZS 3604:2011 with modifications as an Acceptable Solution applies to all regions in New Zealand. The modification to the definition of good ground made for the Canterbury Earthquake Region (to exclude ground subject to liquefaction or lateral spread) still applies, but only to that region.

It is clear that the issue of amending the definition of good ground to include consideration of potential loss of structural support due to liquefaction or lateral spread is both complex and not sufficiently well defined to incorporate in the B1 Compliance Document for the whole country at this point in time.

There is considerable work to be done to: properly specify the performance requirements expected; the conditions under which they apply; how to assess those conditions in a practical and cost effective manner; and to provide cost effective construction solutions. Lessons are still being learnt from Christchurch, and work needs to be done with other Councils to provide some certainty, so that individual engineering investigations are not required for every property.

The Department is researching this, and will develop proposals that would provide robust and effective support for an amended definition of good ground in locations other than the Canterbury Earthquake region and will consult on these proposals.

In the interim, the Department is issuing the following guidance.

## GUIDANCE

The Department recommends to building designers and property owners that where the ground they are building on has potential for liquefaction and/or lateral spread, they seek advice from a chartered professional engineer about using foundation details that provide enhanced performance over those in NZS 3604:2011 (including as it is modified in B1/AS1).

Ground with a potential for liquefaction and/or lateral spread may already have been identified by the Territorial Authority or Regional Council, and may be identified on the LIM (Land Information Memorandum) for the property.

The Department also recommends to Building Consent Authorities that they advise building designers and owners to seek advice from a chartered professional engineer if the property is situated in an identified liquefaction hazard zone on a regional hazard map.

There is potential for liquefaction and/or lateral spread when all of the following conditions occur:

- loose non-cohesive saturated soils that lose a large percentage of their shear resistance under seismic shaking (loose fine sands and many loose silt-sand mixtures), and
- ground saturation – where the liquefaction susceptible material lies below the ground-water table, and
- sufficient shaking to trigger liquefaction (the level of seismic shaking to trigger liquefaction can vary significantly from site to site).

Where there is the potential for minor liquefaction, and provided anticipated lateral spreading across the property is limited to 50mm maximum, chartered professional engineers may advise the use of enhanced house foundations based on the Department's 'Guidance on house repairs and reconstruction following the Canterbury Earthquake', published in December 2010 (available from <http://www.dbh.govt.nz/earthquake-reconstruction-guidance>).

Following the on-going Canterbury earthquake sequence, and particularly the damaging 22 February 2011 Christchurch earthquake, the Department is reviewing the house repair and reconstruction guidance document. The enhanced raft slab options without deep piles are not appropriate on land where there is the possibility of significant settlement during liquefaction. This is likely to occur in areas where the crust (the depth between the ground surface and the water table) is thin, generally occurring in low-lying coastal and estuarine areas.

In areas with major liquefaction potential (lateral spread exceeding the 50mm limit or where there is likely to be significant overall settlement from liquefaction), site specific geotechnical investigations and specific engineering designs using chartered professional engineers are strongly advised.

Designers should refer to the B1/AS1 Acceptable Solution for Structure for full details of the modifications to NZS 3604:2011.

Further information about liquefaction may be found at <http://www.nzgs.org/wp-content/uploads/GeoEarthquakeEngineer.pdf> (NZ Geotech Society guidelines)

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