

## Building on ground with liquefaction potential

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You need an engineer to work out whether you need to build foundations that provide better performance than set out in the current standard, NZS 3604:2011 (including the modifications set out in B1/AS1 and explained in this guidance).

A territorial authority or regional council may have already identified ground with a potential for liquefaction and/or lateral spread. It may be noted on the LIM (Land Information Memorandum) for the property.

If you are a building consent authority, and the property is situated in an identified liquefaction hazard zone on a regional hazard map, you should advise building designers and owners to seek advice from a chartered professional engineer.

Of interest to Building owners, Designers

1st edition

## Conditions that create liquefaction potential

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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 provide 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 MBIE guidance repairing and rebuilding houses affected by the Canterbury earthquakes.

[Repairing and rebuilding houses affected by the Canterbury earthquakes \(https://www.building.govt.nz/building-code-compliance/canterbury-rebuild/repairing-and-rebuilding-houses-affected-by-the-canterbury-earthquakes/\)](https://www.building.govt.nz/building-code-compliance/canterbury-rebuild/repairing-and-rebuilding-houses-affected-by-the-canterbury-earthquakes/)

Following the on-going Canterbury earthquake sequence, and particularly the damaging 22 February 2011 Christchurch earthquake, MBIE 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), you are strongly advised to get a chartered professional engineer to do site specific geotechnical investigations and specific engineering designs.

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 in the Geotechnical guidelines – [Module 3: Identification, assessment and mitigation of liquefaction hazards \(https://www.building.govt.nz/building-code-compliance/b-stability/b1-structure/module-3-identify-liquefaction-hazards/\)](https://www.building.govt.nz/building-code-compliance/b-stability/b1-structure/module-3-identify-liquefaction-hazards/).

## Working with liquefaction potential

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If your land has:

- major liquefaction potential, your chartered professional engineer should carry out a site specific geotechnical investigation and create specific engineering designs (major potential is when the lateral spread exceeds 50mm or where there is likely to be significant overall settlement from liquefaction)
- minor liquefaction potential, your chartered professional engineer may recommend enhanced house foundations. These will be based on MBIE's Guidance on house repairs and reconstruction following the Canterbury Earthquake, published in December 2010 (minor potential is when the anticipated lateral spread across the property does not exceed 50mm).

## Understanding NZS 3604:2011 modifications

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The standard NZS 3604:2011 Timber-framed buildings, and its modification for concrete slabs, is an Acceptable Solution (B1/AS1) for Building Code clause B1 Structure. If you are following B1/AS1, this nationally-applied modification requires you to reinforce all concrete slabs with ductile steel and that you only use details that require perimeter footings to be tied to the slab. You cannot use unreinforced slabs anywhere in New Zealand. You can choose an alternative means to comply with B1.

As an Acceptable Solution, it:

- is suitable where there is "good ground" as defined in that Standard
- applies to all regions in New Zealand as it stands, except in the Canterbury earthquake region
- applies to the Canterbury earthquake region with a modification to the definition of "good ground". The modification excludes ground subject to liquefaction or lateral spread.

The Canterbury earthquake region amendment does not yet apply nationally. This is because the potential loss of structural support due to liquefaction or lateral spread is complex and not sufficiently well defined to incorporate in the B1 Building Code clause acceptable solution or verification method.

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.

This includes:

- properly specifying expected performance requirements
- identifying the conditions they apply to
- outlining how to assess those conditions in a practical and cost effective manner
- providing cost effective construction solutions.

MBIE is researching this, and will develop proposals for consultation that would provide robust and effective support for an amended definition of good ground in locations other than the Canterbury Earthquake region. In the interim, MBIE has issued the guidance.

All guidance related to Canterbury rebuild (<https://www.building.govt.nz/building-code-compliance/canterbury-rebuild/>)

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