BUILDING PERFORMANCE

Understanding the technical categories

In 2011 Christchurch was divided into three technical categories (TC) to determine the level of site investigation required and repair requirements for foundation systems.

Published on 1 February 2013 2nd version

Of interest to Homeowners, Licensed building practitioners

Why were the technical categories developed?

All houses in New Zealand must comply with the New Zealand Building Code which sets national building standards. New Zealand building standards have been upgraded after every major earthquake as knowledge about earthquakes – and designing buildings to resist them – has improved.

The residential green zone technical categories for foundation systems were created to speed the recovery by directing engineering resources to areas of greatest need. They guide consent authorities, engineers, builders and insurance companies to the level of site investigation required and the appropriate foundations for your home. Without the technical categories every site in the green zone would require further deep geotechnical investigation and site specific foundation design.

What was the basis for deciding whether areas were TC1, TC2 or TC3?

The technical categories were established using the information that was known at the time, much of which had been collected following the September and December 2010, and February and June 2011 earthquakes. It included observed land damage data, observed property damage data, ground water information and known soil conditions.

What determined the boundaries of each category?

The boundaries of the technical categories were the result of intensive research and analysis based on a mix of historical and post-earthquake data, discussions with geotechnical consultants and research groups and engineering judgment.

Why can't you recommend foundations for specific sites in TC3?

In TC3 areas liquefaction damage is possible in future large earthquakes and the sub-surface conditions make it uncertain whether TC2 foundations will perform adequately in future earthquakes. Homeowners in TC3 whose foundations need to be rebuilt or substantially repaired need advice from a chartered professional engineer. Sites in TC3 may need deep geotechnical investigation, depending on the degree of damage, and may need site-specific foundations designed by a Chartered Professional Engineer (CPEng).

The technical categories are the starting point which enables engineers, designers and construction companies to decide the most appropriate foundations for your home.

Are site specific foundations unusual?

No, designing foundations to suit ground conditions is not new. There are many other areas of the country where local authorities require specific engineering design for foundations. For example, in parts of Auckland, Northland (where an estimated 40% of houses have engineer-designed foundations), Rotorua, Waikato, Wellington and for most hillside houses nationwide.

Site specific foundations were required in many parts of Canterbury, such as the Port Hills and areas where there are peaty soils, before the 2010 and 2011 earthquakes. It all depends on ground conditions.

Foundations appropriate to ground conditions are a sound investment to safeguard a building that is expected to be around for many years.

What kind of ground underlies the Christchurch area?

The land on which Christchurch and its suburbs are built is made up of sand and sandy gravels, peat, clay and silt, deposited on alluvial gravels derived from glaciers many thousands of years ago. Some material overlaying the deeper gravels was deposited by the sea, when the sea level was higher; some was deposited by rivers; and some built up in swamp areas. Because braided rivers ran across the plain and cut channels, the depth of the underlying gravels varies. Groundwater levels in Christchurch city and the eastern suburbs are very high.

What kind of differences can occur between ground in one area and another?

Ground conditions can be highly variable over comparatively short distances. In some areas of the city there are ‘tongues’ of gravel, interspersed with pockets of silt and peat. On one building site in Christchurch for example, three geotechnical test locations within eight metres of each other all showed different results at depths of four to six metres. At one location the material was relatively loose sand; at another non-liquefiable clay and silts; and at another medium-to-dense gravelly sands. These materials would all behave differently during an earthquake.

What causes liquefaction?

It is a complex process that is not easy to explain. Basically if dry sandy soil is loose or only of medium density, the gaps around the soil grains are filled with air – the grains are not well packed together. When shaken by an earthquake the soil compresses – just as ground coffee compresses when you shake the jar. If you have high groundwater levels, as you do in Christchurch, the gaps between grains are filled with water. In an earthquake the soil wants to compress, but water in the gaps between the soil grains won’t compress – it just builds up water pressure instead. At some point the water pressure gets so high that it exceeds the effect that gravity is having on the soil particles. The soil then turns from solid matter into a heavy liquid, severely reducing its ability to support anything. In a strong earthquake this can happen in two or three seconds.

Why am I in TC3?

Even if you didn’t see signs of liquefaction, it may still have occurred below the surface. Extensive tests in central Christchurch have shown that liquefaction has taken place in areas where there is no apparent surface damage. A thick crust can prevent surface signs of liquefaction (for example, sand boils, water ejection or both) but the area can still suffer liquefaction of subsurface layers. This can damage house foundations.

If liquefaction happens once what is the likelihood of it happening again?

Observations made around the world indicate that if an area suffers liquefaction in a significant earthquake it is likely to liquefy in another event. It is not unusual to build on land that suffers from liquefaction (much in the same way that it is not unusual to build on sloping ground that might be subject to landslips in very large storm events), providing you ensure you get sound engineering advice and build appropriate foundations to support the house.

So is it really safe to rebuild?

You can build on a TC3 property providing you get sound engineering advice and build appropriate foundations to support the house.

Will the technical categories be reviewed over time?

There are no immediate plans for a review. The technical categories are only the starting point for assessing sites that may suffer damage from liquefaction in major earthquakes. There are detailed investigations underway into TC3 properties and these will create an extensive databased of knowledge of sub-surface conditions in TC3 areas.

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