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## Hillside foundations get a shake-up in cutting edge testing

**New shake testing of house foundations aims to ensure homes built on slopes are better able to withstand future earthquakes.**

The Earthquake Commission (EQC) and BRANZ, together with Victoria University, have been testing different foundations on a Porirua farm to investigate how to reduce earthquake damage to homes on hills.

Project lead Roger Shelton from BRANZ says the study follows observations of damage from the Canterbury quakes. “We saw that the same level of shaking caused more damage to homes in Port Hills areas like Cashmere and Redcliffs than it did to homes on the flat.”

BRANZ identified that much of the damage was caused because the foundations of homes on slopes performed poorly in the earthquakes.

“Houses built on slopes may have foundations that are significantly taller at one end than the other, or there may be different types of foundation under the same home,” says Mr Shelton. “This can result in a twisting motion, making earthquake damage more likely.”

BRANZ recognised that New Zealand timber building standards were based on historic practices, and testing on level sites with loadings considerably below those on a sloping site.

With many New Zealand homes built on hills, especially in earthquake-prone areas like Wellington, EQC and BRANZ decided to invest in this vital research to better understand the problem.

Mr Shelton says the best way to find out what happens to foundations in an earthquake was to build a field laboratory and “create a shake”.

“We built four different types of foundations on a sloping paddock north of Wellington, using pile foundations, and combinations of piles and foundation walls,” he says.

“The team used details from the building standard NZS 3604:2011, as well as older, more traditional foundation details.

“We added dead weight to the floors of each foundation to replicate the true mass of the house and used a counter-rotating shaker to simulate an earthquake,” says Mr Shelton.

“During the process, we stop at stages before the foundations are irreparably damaged and try out techniques to reduce damage – then start the shaking again,” says Mr Shelton.

He hopes that his project will provide updated guidance for house foundations on sloping sites for new homes, as well as existing properties.

“We also hope this project will provide approximate costs for different techniques that homeowners can use to strengthen foundations under their existing houses,” he says.

Dr Jo Horrocks, head of Resilience Strategy and Research at EQC, says her organisation was keen to partner with BRANZ because this testing was a great piece of very practical research.

“It’s all about making New Zealand homes more resilient to earthquakes.

“A lot of houses in New Zealand towns are built on slopes. It’s important we understand what’s going to work best on that type of land, not just on flat land, where most of the research has been done until now,” she says.

The BRANZ team expects to have the full results of the testing available in June.

**For further information please contact –**

Jo Martin

Mob: 027 527 9155

Email: [Joanna.martin@branz.co.nz](mailto:Joanna.martin@branz.co.nz)