

Preliminary Risk Analysis

In deciding to move students from one site to another because of earthquake concerns there are so many risk variables to consider, it is hard to know where to start.

But in the short time that was available, I would like to share the findings of one scientific paper that analyzed the correlation between Cone Penetration Tests (CPTs) and actual measured building differential settlement, after the Darfield 2010 Earthquakes in ChristChurch, New Zealand.

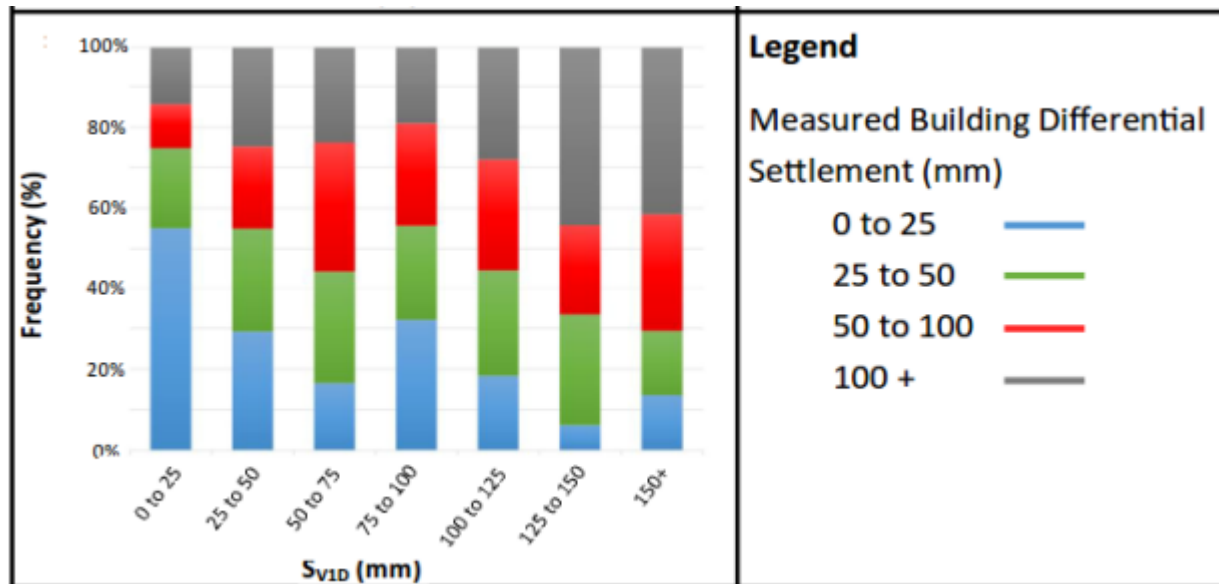
The strongest Darfield quake was 7.3 on the Richter scale, and particularly intense : Maximum acceleration of soil was 1.29 g. The intensity of the quake caused massive liquefaction that damages 45,000 buildings where 12,000 had to be torn down. Noteworthy is that liquefaction caused massive damage, but claimed no lives.

The paper that did the analysis is Chapman et al 2015 :

" Correlation of Differential Building Settlement with Predicted CPT based Liquefaction Vulnerability Parameters"

https://secure.tcc.co.nz/ei/images/ICEGE15%20Papers/Chapman_431.00.pdf

They analyzed the actual measured building differential settlement of thousands of homes and compared that against the calculated differential settlement of thousands of CPT tests.



From this figure we can see that there is a slight trend in the data, but otherwise the calculated (from Cone Penetration Tests) differential settlement parameter Sv1d only loosely correlates with the actual measured building differential settlement.

If you move from a site that had a CPT differential settlement of 4-5" (100-125mm) to a site that had a CPT differential settlement of 1-2" (25-50mm) then you only decrease the risk of significant (>2" (50mm)) actual

building differential settlement by about 10%. In other words, you have a 40% chance of actually increasing the risk to students by moving.

Even more perplexing, if you move from a site that had a CPT calculated differential settlement of 3-4" (75-100mm) to a site that had a CPT calculated differential settlement of 1-2" (25-50mm) then you do not decrease the risk of actual building differential settlement at all. That means that you do not make anyone safer by moving.

These are quite stunning findings that suggest that differential settlement Cone Penetration Test results by themselves are a poor basis for a decision to move students from one site to another.